SEPTEMBER, 1948
Volume XII • Number 6

The INSTITUTE Spokesman

"Model S" Kinematic Viscosity Bath (See Page 3)

In this issue....

Official Publication of NATIONAL LUBRICATING GREASE INSTITUTE

When unquestioned accuracy is essential

The "PRECISION" UNIVERSAL PENETROMETER

For Penetration Tests of Bituminous Materials, Petrolatum and Greases According to A. S. T. M. D5, D217, D937.

Most highly developed and accurate instrument of its type, the "Precision" Penetrometer is recommended for the most stringent penetration tests where unquestioned accuracy is essential. Results are in accordance with the exact definition of penetration.

APPLICATION

The "Precision" Penetrometer is used for penetration tests of bituminous materials, petrolatum, and greases according to A.S.T.M. methods D5, D217 and D937.

For testing bituminous materials, the "Precision" Penetrometer includes one each of 50 and 100 gram weights as specified by A.S.T.M.

OTHER USES

For tenderness testing of processed foods such as bakery products, chocolates and candies, canned fruits and vegetables, etc.

For testing relative tenderness of various cuts of meats, including the effect of quick freezing, cold storage, aging and storing and the combined effect of aging, quick freezing and storing.

Accessories available for the "Precision" Penetrometer give it universal application to many other penetration tests. Write for detailed literature 7-4F.

These exclusive features give the "Precision" Penetrometer its extreme accuracy . . . maintains it throughout its useful life!

Leveling gauge permits finer adjustment, easily and quickly.

Heavy, rigid base will not "spring" or warp from continuous use or excessively heavy test samples.

Speed and ease of manipulation is assured through simplicity of design.

After penetration measurement is made, resetting penetration needle automatically resets dial.

Elevating and lowering device includes clamp which holds operating mechanism securely in place . . . permits moving Penetrometer without disturbing setting.

Hair-trigger release is quick acting, will not stick or bind.

Range of penetration expressed in 1/10 millimeters, allows direct penetration readings to 40 mm in a single sweep of the dial.

Rust resistant finish permits penetration tests on samples, while they are immersed in a constant temperature bath.

Precision Scientific Company

3737 WEST CORTLAND STREET · CHICAGO 47, ILLINOIS, U.S.A.

Scientific Research and Production Control Equipment

Purchase From Your Laboratory Supply Dealer

51-48

ationally Acclaimed eaker to Address 6th Annual Meeting Banquet

m Collins, Popular Humorist d Philosopher, Spends Spare me as Bank Executive

Tom Collins, popular humorist d philosopher, will be guest speaker the 16th Annual N. L. G. I. eting to be held in Chicago, Ocber 11-13.

Often referred to as America's . 1 humorist, he probably has had re repeat requests than any other eaker in the United States. At st 70% of his more than 4,500 lks have been second or more apearances before the same group.

Taking a psychology major in colge, Mr. Collins entered the newsper business, serving in the ediial department of one newspaper d later was Sunday and Literary itor of another.

llywood and Air Waves Old ff to Him

Some years ago this man of any accomplishments went to ollywood and made movie shorts. addition he has also been featured der his own name in several long e radio shows. In all, he has been ard over the air for a total of x years.

eaking Fame of Long Duration

As the 4,500 talks would indite. Tom Collins' speaking career rted quite a few years ago in appearance before a woman's ub. His distinctive style of humor k hold, and it wasn't long before e was swamped with speaking reests; and forced to give up his wspaper career. From then on it s a full life of speaking before n's organizations accompanied by er-growing fame as a top notch eaker.

Banking Post

In 1942 the government drafted r. Collins to serve as War Infortion Advisor of nine middlestern states, where he headed an ganization of 10,000 volunteer eakers. Completing this task with tinction, Tom Collins joined the ff of a bank where he has charge publicity. Although a busy exutive, he still has found time to

TOM COLLINS Will Add His Sparkling Humor to the Annual Banquet.

continue his popular speaking engagements.

It will make no difference whether or not you drink, you will leave the banquet with the distinct feeling that you like "Tom Collins."

ABOUT THE COVER . . .

"MODEL S" KINEMATIC VISCOSITY BATH

The Precision "Model S" Kinematic Viscosity Bath has been designed for Kinematic viscosity determinations with Ostwald, Ubbelohde, or other suspended level viscometers commonly used. The temperature range of the bath is from approximately 70°F. to 212°F., with a sensitivity of plus or minus 0.05°F. or better. Typical among its applications are tests according to A. S. T. M. Method D445, "Method of Test of Kinematic Viscosity".

The bath is constructed of a 12" diameter by 18" high Pyrex jar, with walls 3/16" thick, which holds the bath liquid, usually oil. This rests on a cork ring placed on the base, which also contains all controls. The top for the bath is constructed of ½" thick Bakelite. To provide insulation for the bath, a stainless steel jacket with a large Plexiglass window fits over the jar, with an

The INSTITUTE SPOKESMAN

Published monthly by

THE NATIONAL LUBRICATING GREASE INSTITUTE

HARRY F. BENNETTS ...... *Editor*

4638 Millcreek Parkway

Kansas City 2, Mo.

air space of about ¾" between bath and jacket.

Two immersion heaters, 300 watts and 500 watts, provide heat.

Overall dimensions: 35" high x 20" diameter.

Liquid capacity of Pyrex jar: 7 gallons.

Total watts: 900.

Complete information available on request.

PRECISION SCIENTIFIC CO.
CHICAGO 47, ILL.

INDUSTRIAL USES *of some* Polyether Synthetic Lubricants

by W. H. MILLETT
Carbide and Carbon
Chemicals Corporation
Tonawanda, New York

. . . . although synthetic lubricants may be initially relatively expensive at the present, superior performance during operation may more than justify their use . . .

In recent years there has been a widespread interest in the commercial availability and utilization of various types of synthetic oils and lubricants. These synthetic products may be roughly classified into two distinct groups. One group is composed of synthetic hydrocarbons. These materials are similar in chemical structure and physical properties to the conventional petroleum oils with which we are all familiar. The second group is composed of non-hydrocarbon synthetics. Because of their different chemical constitution, these synthetics will be expected to differ markedly in many respects from mineral oil products, vegetable and animal oils and fats. The term "synthetic" in chemical language refers to products which are built up from the elements or from smaller molecules and as used herein does not imply that the products are substitutes or "ersatz" materials. The possibility of utilizing their unusual properties in solving various industrial lubrication problems is worthy of consideration.

One of the commercially available, non-hydrocarbon synthetics is the family of synthetic lubricants marketed under the brand name "Ucon"* (1-5)†. These materials are members of the family of chemical compounds known as polyalkylene glycols and derivatives and may be described by the general term, polyethers. At the present time three series are being manufactured in commercial quantities; namely, the "LB", "50-HB", and "75-H" series. In the nomenclature of these synthetics, the number which follows the type classification represents the approximate Saybolt Second viscosity at 100°F. An "X" following the viscosity in the code name indicates the presence of a standardized oxidation inhibitor and is recommended in cases where improved oxidation stability is desired. The letter "Y" in the symbol indicates the use of an additive, other than the standardized antioxidant, to impart improved extreme pressure characteristics, "oiliness" properties, etc.

These fluids are polymeric materials and can be made to any desired viscosity within the particular limitations of the reaction involved. Whereas, conventional petroleum lubricants are mutually insoluble with water, the "LB" series is characterized by water tolerance of the order of 1 to 3 per cent, and the "50-HB" and "75-H" series are characterized by water miscibility at ordinary temperatures. Viscosity indices of the synthetics are high[illegible] than those of non-additive mine[illegible] oils, and in general their stable po[illegible] points are considerably lower. The[illegible] also differ from conventional lub[illegible]cants in that there is no mark[illegible] tendency for their oxidation pro[illegible]ucts to form insoluble sludges a[illegible] that they tend to burn-off practical[illegible] completely from metal surfaces whe[illegible] maintained at elevated temperature[illegible] Because of these different and i[illegible]teresting properties, it will be worth[illegible]while to consider them and the[illegible] application in more detail.

Properties of the Lubricants

The physical and chemical pro[illegible]erties of various members of eac[illegible] series of these synthetic lubricant[illegible] are tabulated in Table I-IV. In[illegible]spection of these tables will reve[illegible] the following general properties:

1. Viscosity-temperature chara[illegible]teristics of the lubricants are ve[illegible] favorable. Viscosity indices, in ge[illegible]eral, range from 135 to 155 depen[illegible]ing on the type and viscosity of t[illegible] product. Although this is outsi[illegible]

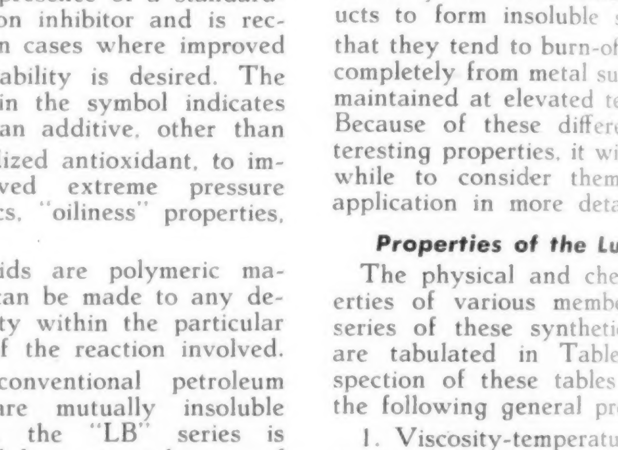

Figure 1—Viscosity-temperature chart of polyether synthetic lubricants LB-170-X and LB-300-X

Presented before AISE Annual Convention, Pittsburgh, Pennsylvania, September 24, 1947

*Trade Mark, Carbide and Carbon Chemicals Corporation.

†Numbers refer to bibliography at end of paper.

(Reprinted from The Iron and Steel Engineer, August, 1948)

range for which the concept of viscosity index was originally established, it is the most convenient and generally utilized means of referring to the viscosity-temperature properties of a lubricant. Because of the high viscosity indices, classification of the lubricants according to standard SAE grades is not feasible since these liquids will correspond to different grades at different temperatures. This is readily illustrated by the viscosity-temperature chart shown in Figure 1. The high viscosity indices are not attained through the use of additives but are inherent properties of the fluids themselves.

2. The pour points of these lubricants are considerably lower than would be expected of mineral oils of comparable viscosities. There are no pour point depressants in these synthetics, and since they contain no wax, pour points are completely reproducible when determined by the cyclic ASTM method or similar procedures.

3. Flash points are comparable to or slightly higher than those of mineral oils of comparable viscosities.

4. Specific gravities of these synthetic lubricants are high and range from 0.98 to 1.09 at 60°F depending on the type and viscosity of the product, as compared with values ranging from 0.86 to 0.92 for petroleum oils.

There are several other properties which render these synthetics of interest and which distinguish them from oils in conventional use. The following inherent characteristics are particularly noteworthy:

1. *Non-sludging characteristics*—The principal oxidation product of these synthetic lubricants are either volatile compounds of low molecular weight or compounds having similar properties to those of the original fluid. Because of this, the formation of insoluble sludges is minimized provided systems are adequately ventilated. This is particularly noticeable after prolonged operation. Under these conditions, mineral oil oxidation products may polymerize and form insoluble sludges which frequently interfere with the effective operation of the lubricated mechanism.

2. *Burn-off properties* — Closely allied to the non-sludging characteristics is the essentially complete burn-off obtained with these synthetics when maintained without replacement at elevated temperatures. This property is attributed to the volatility of their oxidation and decomposition products and minimizes the formation of undesirable carbonaceous deposits.

3. *Effect on rubber*—An interesting property of the synthetic lubricants is their low solvent and swelling effect on most natural and synthetic rubbers. In general, the swelling or softening effect is negligible, however in some cases plasticizers or other compounding ingredients have been removed from synthetic rubbers because of the solvent action of the oil. Swelling data for typical lubricants with various types of rubbers are shown in Table V.

4. *Solubility relationships* — As mentioned previously, members of the "50-HB" and "75-H" series are soluble in water at normal temperatures. This permits the formulation of aqueous solutions of the lubricant which have been shown to be of value as textile fiber and rubber lubricants. This unique property will undoubtedly result in the develop-

(Continued to page 6)

TABLE I

Typical Properties of Standard Grades of LB Series Lubricants

Standard Grade	LB-135	LB-165	LB-285	LB-385	LB-525	LB-625	LB-1145
Viscosity							
Saybolt seconds at 210°F.	45.1	48.6	62.7	75.1	93.1	106	177
Saybolt seconds at 100°F.	135	165	285	385	525	625	1,145
Saybolt seconds at 0°F.	4,700	6,400	14,200	21,600	33,000	41,000	92,000
Centistokes at 210°F.	5.77	6.85	11.0	14.3	18.8	21.9	37.8
Centistokes at 100°F.	28.7	35.4	61.7	83.3	114	135	248
Centistokes at 0°F.	1,025	1,400	3,100	4,700	7,200	8,900	20,000
Centistokes at —20°F.	3,950	5,550	14,000	23,000	38,000	50,000	
Centistokes at —40°F.	22,500	35,000					
Viscosity index, (ASTM D-567-41)	148	148	146	144	143	141	137
Pour point, F, (ASTM D-97-39)	—55	—50	—40	—35	—30	—25	—20
Flash point, open cup, F, (ASTM D-92-45)	300	410	425	430	430	430	430
Fire point, open cup, F, (ASTM D-92-45)	350	460	490	500	505	510	510
Density, g/cc							
At 210°F.	0.919	0.921	0.930	0.935	0.938	0.939	0.942
At 100°F.	0.965	0.967	0.975	0.980	0.983	0.984	0.987
At 60°F.	0.981	0.983	0.992	0.996	1.000	1.001	1.003

TABLE II

Typical Properties of Standard Grades of LB-X Series Lubricants

Standard Grade	LB-140-X	LB-170-X	LB-300-X	LB-400-X	LB-550-X	LB-650-X	LB-1220-X
Viscosity							
Saybolt seconds at 210°F.	44.9	48.4	62.7	74.3	93.1	106	183
Saybolt seconds at 100°F.	140	170	300	400	550	650	1,200
Saybolt seconds at 0°F.	5,820	8,000	18,400	26,600	40,400	50,500	110,000
Centistokes at 210°F.	5.7	6.80	11.0	14.1	18.8	21.9	39
Centistokes at 100°F.	29.8	36.5	65.0	86.6	119	141	260
Centistokes at 0°F.	1,270	1,740	4,000	5,800	8,800	11,000	24,000
Centistokes at —20°F.	5,100	7,200	18,500	29,000	47,000		
Centistokes at —40°F.	34,000	50,000					
Viscosity index, (ASTM D-567-41)	140	144	142	141	141	140	136
Pour point, F, (ASTM D-97-39)	—50	—45	—40	—30	—25	—20	—15
Flash point, open cup, F, (ASTM D-92-45)	345	440	490	490	490	490	490
Fire point, open cup, F, (ASTM D-92-45)	410	530	585	595	600	605	610
Density, g/cc							
At 210°F.	0.918	0.924	0.933	0.936	0.938	0.939	0.943
At 100°F.	0.967	0.971	0.979	0.981	0.984	0.985	0.989
Specific gravity, 60/60°F.	0.985	0.990	0.997	0.999	1.001	1.002	1.007

TABLE III

Typical Properties of Standard Grades of 50-HB Series Lubricants

Standard grade	50-HB-55	50-HB-170	50-HB-260	50-HB-400	50-HB-660	50-HB-2000	50-HB-3520	50-HB-[illegible]100	50-HB-280-X
Viscosity									
Saybolt seconds									
at 210°F	34.3	51.0	63.8	84.5	125	335	558	781	64.6
at 100°F.	55	170	260	400	660	2,000	3,520	5,100	280
at 0°F.	712	5,050	9,200	16,000	30,700	115,000	220,000*	330,000*	11,400
Centistokes									
at 210°F.	2.4	7.6	11.3	16.7	26.2	72	120	168	11.5
at 100°F.	8.9	36.5	56.2	86.6	143	433	762	1,104	60.6
at 0°F.	155	1,100	2,000	3,500	6,700	25,000	48,000*	71,000*	2,480
at —20°F.	460	4,000	7,700	14,000	26,000	....	....	....	9,800
at —40°F.	1,800	20,000	45,000	....	....	....	....	....	
Viscosity index (ASTM D-567-41)	97	156	153	149	144	133	....	....	150
Pour point, F (ASTM D-97-39)	—85	—45	—40	—35	—30	—25	—20	—20	—35
Flash point, open cup, F (ASTM D-92-45)	260	410	410	430	430	440	440	450	500
Fire point, open cup, F (ASTM D-92-45)	285	475	500	535	545	545	545	545	600
Density, g/cc									
At 210°F.	0.920	0.967	0.977	0.984	0.991	0.998	1.001	1.003	0.97[illegible]
At 100°F.	0.972	1.014	1.023	1.030	1.037	1.043	1.046	1.048	1.02[illegible]
At 60°F.	0.993	1.031	1.040	1.047	1.054	1.060	1.063	1.065	1.04[illegible]

*Extrapolated value.

SYNTHETIC LUBRICANTS

(Continued from page 5)

ment of other interesting applications. Although the "LB" series is frequently characterized as being water insoluble, this classification is apt to be misleading. In actuality, members of this series will dissolve up to 3 per cent water in true solution at normal temperatures. This enables the lubricants to take up small amounts of water contamination without the formation of troublesome, emulsion-type sludges.

Since the synthetics have different molecular structures than those of conventional oils, one would expect different solubility characteristics. This behavior is readily apparent in the case of water. The mutual solubility relationships of these polyethers with organic solvents, mineral and vegetable oils, and various natural and synthetic resins are equally interesting. Representative data showing the solubility of these fluids in selected organic solvents are shown in Table VI. For some applications these characteristics may prove to be favorable to the synthetics, and in others they may prove unfavorable. In either case, it should be emphasized that these synthetic lubricants exhibit many unusual solubility relationships.

Uses of the Lubricants

During the past two years there have been many instances in which the unique properties of these synthetics have met the requirements of certain industrial lubrication problems. The high temperature and drastic conditions encountered throughout the iron and steel industry are providing a wide number of such applications and there is no doubt that many more will be forthcoming. A discussion of the available and pertinent details of some of these specific uses is presented as an indication of the type of performance which may be expected from the synthetic lubricants.

Hydraulic Oils

Precision machine tools — The combination of viscosity-temperature properties and non-sludging characteristics would appear to render the synthetics of value as oils for hydraulically actuated precision machine tools. Fluids such as LB-140-X, LB-170-X, and LB-300-X have been used as the actuating fluid in various hydraulically operated milling and grinding machines. In all of them, excellent performance characteristics have been reported. Of principal interest is the reported cleanliness of the hydraulic systems and the elimination of gumming and valve clogging troubles. In several instances it was stated that difficulties due to coolant and emulsifiable cutting oil leakage were eliminated. One difficulty which has been noticed in connection with this application is the tendency, in a few instances, for the synthetic oil to

TABLE IV

Typical Properties of Representative 75-H Series Lubricants

Viscosity	75-H-490	75-H-1400	75-H-9150
Saybolt seconds at 210°F.	88	197	1,187
Saybolt seconds at 130°F.	258	700	4,720
Saybolt seconds at 100° F.	490	1,400	9,150
Centistokes at 210°F.	17.5	42.6	257
Centistokes at 130°F.	55.6	151	1,020
Centistokes at 100°F.	106	303	1,980
Viscosity index (ASTM D-567-41)	143	135	....
Pour point, F (ASTM D-97-39)	5	20	40
Flash point, open cup, F (ASTM D-92-45)	445	475	405
Fire point, open cup, F (ASTM D-92-45)	525	....	490
Specific gravity, 20/20 C	1.092	1.093	1.089
Density, g/cc			
At 210°F.	1.030	1.030	1.027
At 100°F.	1.076	1.077	1.073

exert a solvent action on some types of paints. For this reason, it would be desirable to check the effect of the oil on any paints in the system prior to filling the system with the synthetic oil.

Pressure welding machine — Another closely related application, largely dependent on the favorable viscosity-temperature-pressure relationships, is the use of the synthetic oils in various types of equipment employing hydraulic pressure. A typical instance is the use of LB-140-X in a pressure welding machine where constant pressures must be maintained throughout an appreciable ambient temperature range. A picture of a section of the machine is shown in Figure 2. This unit is equipped with a two-stage vane pump delivering 4.5 gallons per minute at a constant pressure of 1500 psi and powered by a 7½ hp motor. The unit operates from 8 to 10 hours per day.

A good grade of an SAE 20 oil was previously used. Frequent renewals were necessitated, oil foaming had been a problem, and it had been difficult to maintain constant pressures over a range of oil and ambient temperatures. After introducing LB-140-X into the system, it was observed that the unit would operate at constant pressure regardless of the operating temperature of the oil. It would start on a cold morning with the same valve setting as was used during operation on a hot day. Ambient temperatures have ranged from —4°F to 100°F.

(Continued to page 18)

TABLE VI
Solubility of Selected Synthetic Lubricants in Various Organic Solvents
(Solubilities determined at room temperature unless otherwise specified.)

Solvent	Lubricant 50-HB-260	Lubricant LB-400
Acetone	S	S
Benzene	S	S
Carbon tetrachloride	S	S
Ethylene glycol	I (SH)	I (SH)
Glycerine	I	I
Heptane	I	S
Kerosene	I	S
Methanol	S	S
Petroleum ether	I	S
Toluene	S	S
Water	S (IH)	I

Key: S—Soluble I—Insoluble SH—Soluble, hot IH—Insoluble, hot

TABLE V
Effect of Synthetic Lubricants on Rubber

Rubber	Linear per cent swelling LB-285	Linear per cent swelling 50-HB-260	Condition of immersion
Natural	2 to 3	—1 to 1	5 Days, 160°F.
Buna S	8 to 10	1 to 2	20 Days, 212°F.
Buna N	0 to—1	0 to 1	5 Days, 160°F.
Butyl	0 to—2	—2 to—3	20 Days, 212°F.

Mallinckrodt Chemical Joins N. L. G. I.

Name C. E. Cosby as Company Representative and H. C. Mounce to Technical Committee

Established more than eighty years ago, Mallinckrodt Chemical Works entered the metallic soap field early in this century with the production of zinc stearate. By 1921, the Company was furnishing aluminum stearate to the grease industries, and subsequently originated the practice of supplying aluminum stearates of fixed acid-base ratios—the mono-stearate, di-stearate, and tri-stearate—in order that manufacturers in the grease and lubricant industries might with greater facility make the most of the remarkable effects of the acid-base ratio on aluminum stearate gels.

During the years Mallinckrodt has developed various kinds and grades of stearates, often "custom-made". Their aluminum stearates, barium stearates, calcium stearates, magnesium stearates, sodium stearates, strontium stearates and zinc stearates have found a multiplicity of applications in a wide variety of fields: the grease industry; the paint, varnish, and lacquer field; the manufacture of paper and paper coatings; cement making; pharmaceuticals; cosmetics; synthetic rubber; waterproofing and water-repellent preparations; plastic molding, and release agents.

A continuous, unbroken research program on the stearates has been maintained by Mallinckrodt since the early twenties in a laboratory well equipped for control and research on greases, and the services performed by the research group are being constantly extended to new fields and new problems.

Mallinckrodt is well known for its manufacture of fine chemicals for medicinal, photographic, analytical and industrial purposes.

Mallinckrodt plants are located at St. Louis, Jersey City, N. J., and Montreal, Quebec. Offices are maintained in New York, Chicago, Philadelphia, Los Angeles, Cleveland, Cincinnati and San Francisco.

HAIRMAN T. G. ROEHNER, DIRECTOR OF THE TECHNICAL SERVICE DEPARTMENT, SOCONY-VACUUM LABORATORIES.

Some progress is being made in rranging for the agenda for the October 13th meeting of the Tech-ical Committee. The usual reports ill be presented, summarizing the ctivities of other organizations orking on grease problems, par-icularly the ABEC-NLGI Coopera-ive Committee on Grease Test Methods. Time will also be pro-ided for a thorough discussion of ASTM Committee C-7, Subcom-ittee III's proposal of a specifica-ion for lime for use in the manu-acture of greases. The Panel work-g on the Committee's project on Delivery Characteristics of Dispens-g Equipment for Lubricating Greases will review their program d will welcome comments regard-g that project.

It has been suggested that in ad-ition to committee reports, the enda should list problems which ffect efficiency of manufacturing perations. A call has been made for olunteers to initiate discussions of uch subjects, including instrumen-tion, pumps, metering devices and lters. Dependent on the reaction to hose disscusions, projects may be stablished to assemble available ata on such equipment and possibly n K values of heat transfer units nd other engineering factors. Your uggestions regarding subjects for he meeting should be sent in romptly, so that they may be in-luded in the agenda for distribution efore the meeting.

Supplement to Technical Committee Column

MODIFIED LOW TEMPERATURE TORQUE TEST

The ABEC—NLGI Cooperative Committee on Grease Test Methods ublished their Technical Bulletin No. 1 in 1944. It had four parts, the titles of which were the following:

1. Tentative Method for Determination of Low Temperature Torque Characteristics of Greases in Anti-Friction Bearings.
2. S.O.D. Pressure-Viscosimeter.
3. S.O.D. Pressure-Viscosimeter for Low Temperatures
3. The Measurement of Low Temperatures by Thermal Electric Procedures

Thereafter the Committee continued work on their project and the out come of that further activity is represented by the Supplement to ABEC—NLGI Technical Bulletin No. 1, which is copied below. It should be noted that the Supplement actually applies only to the first part of the four parts listed above. Surveys conducted by the Committee show that the modified method is an important improvement in respect to reproducibility.

SCOPE:

The method of test covers the procedure to be used for determining the low temperature torque characteristics of lubricating greases in anti-friction bearings at sub-zero temperatures and at slow operating speeds.

APPARATUS:

The apparatus required follows:

(a) Test spindle complete with test bearing and loose side shields as shown on ABEC 18-1070-M.

(b) Low temperature box with receiver tubes to accomodate two or more test spindles as per American Instrument Company Sub-Zero Test Cabinet 4-3350, or equivalent. Temperatures within the test chamber shall not vary more than $+0.5°$F. from the temperature required to maintain the test spindle at any test temperature over the operating range of —30°F. to —100°F.

(c) The Temperature measuring equipment calibrated to provide temperature measurements to an accuracy of $+0.5°$F. over the temperature range of 0.°F. to —120°F. Copper-constantan thermocouples and Leeds & Northrup portable potentiometer, Catalog No. 8663, or equivalent, with a specified range of 0°F to —120°F. are recommended.

PREPARATION AND LUBRICATION OF TEST BEARING:

The test bearing shall be washed by hand by spinning it partly submerged in a bowl of Stoddard Solvent (ASTM D484-40) and repeating this operation in fresh Stoddard Solvent until the bearing is clean and free from all lubricant. The bearing shall then be rinsed by spinning in a bowl of clean petroleum ether having properties as described in ASTM (D128-40) reagents, and flash dried in an oven at 160°F. just prior to lubrication. Test bearings containing lubricants from previous tests which are difficult to clean may receive a preliminary cleaning by soaking in a warm solution made up of benzol and alcohol in equal parts prior to the final hand washes in Stoddard Solvent and petroleum ether. Chlorinated solvents must not be substituted for the recommended cleaning solvents. The bearing shall then be packed by hand with $3.0+0.1$ grams or the grease to be tested, weighed by difference from a glass sample dish. The grease shall be worked uniformly into both sides of the bearing using a narrow-blade spatula, making sure that grease does not extend beyond the face of the races. The loose side shields shall then be applied to both sides of the bearing and held tightly in position while the assembly is pushed over a stud, ABEC 18-1070-N-2, and held so as to rotate the inner ring for one minute at a speed of 200 to 250 r.p.m. while the outer ring and side shields are held stationary. The bearing assembly is removed from the stud, turned over and again pushed on the stud, and the inner ring rotated for one minute with the outer ring and side shields held stationary. The running-in operation provided by rotating the inner ring and ball train in both directions distributes the

(Continued to page 12)

TECHNICAL COMMITTEE

(Continued from page 11)

grease uniformly over the internal surfaces of the test bearing.

ASSEMBLY OF TEST BEARING IN TEST SPINDLE:

The lubricated test bearing with side shields in position is carefully fitted into the outer ring bearing adapter without disturbing the side shields. The inner ring adapter is then fitted in the bearing bore and this sub-assembly is assembled in the test spindle as shown in ABEC 18-1070-M. The spindle is placed in a verticle position with the shaft extension upward, the set screw on collar ABEC 18-1070-M-9 is loosened and the 5-pound preloading weight (ABEC 18-1070-N-3) is applied to this collar and the set screw then tightened. The shaft is turned slowly by hand to check for free rotation clockwise and counter-clockwise, and the spindle is then located and locked in its proper position in the cold test box. Test pulley ABEC 18-1070-M-8 is located and locked on the shaft extension as required for load applications.

PROCEDURE:

The spindle assembly is chilled to +20°F. as rapidly as possible (approximately ½ hour required) and from this point on, the temperature is reduced at the rate of 5°F. per 20 minutes (15°F. per hour). A torque of 1,000 gram centimeters is applied at 20-minute intervals starting at +20°F. The time for one revolution and the corresponding temperature of the test bearing is observed and recorded for both clockwise and counter-clockwise rotation. Tests are continued at 20-minute intervals until one or more values are obtained at least 10 seconds more than the required 30 seconds per revolution (Plasticity Number of 30,000). The values observed in seconds per revolution are plotted against their corresponding temperatures and the temperature required for 30 sec./rev. with the 1,000 gram centimeter torque is determined by interpolation from this curve.

It should be understood that the Plasticity Number of 30,000 mentioned above is merely by way of example since other Plasticity Numbers may be used.

CALCULATIONS AND REPORT FORMS:

The temperature at which an applied torque of........ gram centimeters requires........ seconds for one revolution of the test bearing is reported as the temperature at which a Plasticity Number of ....is reached.

REPRODUCIBILITY OF RESULTS:

Cooperative tests by three laboratories using this method indicate that the lowet temperature at which a Plasticity Number of 30,000 is reached can be reproduced within +5°F. as shown by the data in the table below.

REPRODUCIBILITY OF THE LOWEST USABLE TEMPERATURE

	Fafnir Bearing No. 204				Norma Hoffmann Bearing No. 204			
Laboratory	A	B	C	Avg.	A	B	C	Avg.
Grease G-6°F.*	-83.5	-77.0	-81.0	-80.5	-78.5	-74.0	-80.0	-77.5
Grease G-7,°F.*	-63.5	-63.0	-65.0	-63.8	-63.5	-63.0	-68.0	-64.8
Grease G-77,°F.*	-88.5	-88.0	-90.5	-89.5	-80.3	-88.0	-94.0	-90.7

*Temperature for a Plasticity Number (P.N.) of 30,000 P.N. determined by using 1,000 g. cm. torque and recording the time for one revolution.

Temperature—sec./rev. graph used to inter-polate temperature at which 30 sec./rev. would be required

Day & Night! IT'S THE EDGEWATER BEACH HOTEL - - CHICAGO .. HEADQUARTERS FOR 16th ANNUAL N.L.G.I. MEETING

Day ....

Outstanding speakers presenting and discussing your current industry advancements and problems. Attend the Annual Business Meeting and see the new Officers and Directors who will represent you and your industry next year.

and Night ....

Meet the people of your industry. The popular Social Hour and Annual Banquet are high-lights for this occasion.

THESE, AND OTHER, OUTSTANDING SPEAKERS WILL APPEAR ON THE PROGRAM:

Mr. Gus Kaufman
The Texas Company
New York, New York
"TESTING MACHINE FOR EVALUATION OF BALL AND ROLLER GREASES"

The name of Gus Kaufman has been prominent in the Texas Company since 1924 when he received his Bachelor of Science degree in Chemical Engineering with Distinction from the Rice Institute, Houston, Texas.

Mr. Kaufman, who was born on September 3, 1903, was brought to the Lone Star state as a child; and attended grade school and high school in Houston.

Assistant to the Manager of the Technical and Research Division is Mr. Kaufman's present position, and, for the most part, he has been with this division since joining the Texas Company.

Mr. Gus Kaufman

His first work in petroleum research embraced distillation and fractionation, and, after plant work in this field and in grease manufacture, he was placed in charge of grease research at the Port Arthur, Texas, Laboratories and later at the Beacon, New York Laboratories.

In 1941, he was transferred to the New York offices as Staff Technologist and then to his present position.

In his almost twenty-five years of experience in lubricating grease and allied products, which included all phases from the laboratory through the plant to the field, Mr. Kaufman has been the author of many patents

and publications on lubricating greases, cutting oils, gear lubricants and allied subjects.

His name is found on the membership list of such organizations as Tau Beta Phi, American Chemical Society, American Institute of Chemical Engineers, as well as various technical committees of such organizations as the Coordinating Research Council, American Society for Testing Materials and the National Lubricating Grease Institute.

Mr. Kaufman's hobbies are mainly along sport lines, in particular, golf. He is a member of the Southern Dutchess Country Club, the Elks Club, and the Rice Institute Alumni Association.

He is unmarried.

Mr. Charles J. Boner
Battenfeld Grease and Oil Corporation
Kansas City, Missouri

"SOAP AS A LUBRICANT"

Charles J. Boner is a midwesterner by birth and education. Born in Kansas, he received his education at the University of Missouri, where he obtained a degree in Chemical Engineering.

Mr. Boner has been with the Battenfeld Grease & Oil Corporation for twenty-one years, and for the past twelve years has been responsible for the direction of their Research Program.

A member of the American Chemical Society, he is past Chairman of the Kansas City Section. He is also on the staff of Chemical Abstracts.

Author of numerous articles, Mr. Boner has a chapter in Volume VI of *Alexander's Colloid Chemistry*, covering *"Colloidal Characteristics of Lubricating Greases"*.

Mr. M. D. Gjerde
Standard Oil Company (Indiana)
Chicago, Illinois

"THE IMPORTANCE OF PROPER LUBRICANTS FOR FARM MACHINERY"

M. D. ("Doc") Gjerde, Manager of Sales Technical Service Department, Standard Oil Company (Indiana), was graduated from Purdue University with a B. S. degree in Mechanical Engineering.

In 1923 Mr. Gjerde joined the Standard Oil Company and received special training at Whiting, Indiana. Later, he was assigned to lubrication engineering and sales work in several of their fields.

In 1928 he was transferred to the General Office, Chicago, and after several years of engineering work on special accounts, he was appointed to his present position in 1937.

A member of SAE, Mr. Gjerde is now Vice-Chairman of the Fuels and Lubricants Technical Committee for that organization. A very active member of the American Petroleum Institute, he serves on both it's Lubrication and Executive Committees.

Mr. O. L. Maag

Mr. O. L. Maag
The Timken Roller Bearing Company
Canton, Ohio

"LUBRICANTS FOR VARIOUS ROLLER BEARING APPLICATIONS"

For twenty-five years Mr. O. L. Maag has held the position of Research Chemist and Lubricating Engineer with the Timken Roller Bearing Company.

Preceding his position with the Timken Company, he was one year as Chief Chemist for the Kansas City Testing Laboratories, two years as a Research Chemist with the U. S. Bureau of Standards, and four years as an Assistant Chief Chemist in charge of Research Laboratories of the Galena Signal Oil Company.

In 1915 Mr. Maag completed his college training at the University of Kansas with both B. S. and M. S. degrees.

He is a member of the American Chemical Society, the Society of Automobile Engineers, the American Society for Testing Materials, the American Society of Lubricating Engineers, and has worked on several committees of the Coordinating Research Council.

Mr. H. M. Fraser

Mr. H. M. Fraser
International Lubricant Corporation
New Orleans, Louisiana

"MULTI-PURPOSE AUTOMOTIVE GREASES"

For the past few years H. M. Fraser of the International Lubricant Corporation has devoted his

time primarily to the development, testing and manufacture of a new Lithium Multi-Purpose Grease.

Mr. Fraser has been with International since 1929 when he assumed the position of Vice President in charge of Production and Research.

Mr. H. Reynolds
The Fafnir Bearing Company
New Britain, Connecticut

"LUBRICATION OF ANTI-FRICTION BEARINGS FROM A BEARING MANUFACTURER'S VIEWPOINT"

H. Reynolds, Chief Engineer of the Fafnir Bearing Company, has been with this firm since he first started in the ball bearing business in 1910.

Mr. C. W. Georgi
Quaker State Oil
Refining Corporation
Oil City, Pennsylvania

"EFFECT OF INORGANIC FILLERS IN GREASES ON WEAR OF ANTI-FIRCTION BEARINGS"

Mr. Howard Cooper
The Sinclair Refining Company
New York, New York

"FOUR POINT COOPERATION FOR SATISFACTORY GREASE LUBRICATION

Howard Cooper is a graduate of the Armour Institute of Technology where he received his B. S. degree in mechanical engineering. One year after graduation Mr. Cooper entered the oil industry as a lubrication engineer for The Texas Company in Chicago.

During World War I he served in the Fuels and Lubricants Section of the Signal Corps, later designated as Air Service.

Following the war Mr. Cooper returned to The Texas Company and, with the exception of one and one half years on an experimental project, has been associated with lubrication continuously since. He joined Sinclair in 1922.

Mr. Cooper spent three and one half years in Washington on loan to the Marketing Division of P. A. W.

F. W. Spooner
Shell Oil Co., Inc.
New York, N. Y.

"MULTI-PURPOSE AUTOMOTIVE GREASE"

Born in Grand Rapids, Michigan, F. W. Spooner attended Purdue and Cornell Universities. He entered the employ of the Shell Oil Company, Incorporated, in 1933 upon graduation as a mechanical engineer from Cornell.

After six years with that corporation in Indiana and Missouri as a Lubrication Engineer, Mr. Spooner was transferred to the New York Head Office of Shell's Lubricants Department. During four war years he served as a reserve officer in the Navy doing production engineering at the Navy operated torpedo plant located at Newport, Rhode Island. He is now in the Head Office with Shell as staff engineer, handling matters concerned with automotive and industrial grease lubrication.

Mr. F. E. Lacey
Swift & Company
Chicago, Illinois

"MODERN DEVELOPMENTS IN FATS FOR GREASE MANUFACTURE"

F. E. Lacey joined Swift & Company in 1926, shortly after being graduated from the University of Missouri. In the 22 years since then he has been associated with the fat and oil business of the company.

Mr. F. W. Spooner

After a period of student training at South St. Joseph, Lacey was engaged in sales work in New York City and Toronto. He returned to the general offices of the company in Chicago in 1928 and for the next 16 years was associated with the procurement and sales of fat and oil for the company.

He was appointed manager of the industrial oil department in 1944. Growth of this phase of the company's business is reflected in the new industrial oil plant now nearing completion at Hammond, Ind. This new unit will process fat and oil for use in the manufacture of lubricants, rubber, textiles, soap, cosmetics, linoleum, paint, and many other industrial products.

Mr. F. E. Lacey

TENTATIVE PROGRAM
of the
NATIONAL LUBRICATING GREASE INSTITUTE
EDGEWATER BEACH HOTEL
CHICAGO, ILL.
OCTOBER 11-12-13, 1948

Registration—8:30 a.m.

Monday through Wednesday
The 11th through the 13th

Southeast corner of the Passagio.

Fee $1.00 for all members and guests.

MONDAY, OCTOBER 11, 1948

Morning Session—10 a.m.—Ballroom

Address of Welcome
MR. J. R. CORBETT, President, N. L. G. I.
Cato Oil and Grease Co.
Oklahoma City, Oklahoma

"Multi-Purpose Automotive Grease"
F. W. SPOONER, Shell Oil Company, and
H. FRASER, International Lubricant Corp.

"Modern Developments in Fats for Grease Manufacture"
F. E. LACEY, Swift & Company

Board of Directors Meeting and Luncheon
Lincoln Room
12:30 P. M.

Afternoon Session—2 p.m.—Ballroom

"The Importance of Proper Lubrication of Farm Machinery"
LEWIS S. PLETT,
Minneapolis Moline Power Implement Company

"The Importance of Proper Lubricants for Farm Machinery"
M. D. GJERDE,
Standard Oil Company (Ind.)

"Four Point Cooperation for Satisfactory Grease Lubrication"
HOWARD COOPER,
Sinclair Refining Corporation

"Defense Requirements of Lubricants Relating Especially to Greases"
COL. L. E. COTULLA, Executive Officer,
Armed Services
Petroleum Purchasing Agency

Annual Business Meeting
4:30 P. M.

TUESDAY, OCTOBER 12, 1948

Morning Session—9 a.m.—Ballroom

"Lubrication of Anti-Friction Bearings from A Bearing Manufacturer's Viewpoint"
MR. H. REYNOLDS,
The Fafnir Bearing Company

"Lubricants for Various Roller Bearing Applications"
MR. O. L. MAAG,
The Timken Roller Bearing Company

"Testing Machine for Evaluation of Ball and Roller Greases"
MR. GUS KAUFMAN, The Texas Company
(Prepared in conjunction with Messrs.
W. A. Prendergast and R. F. Strohecker
of the Beacon Laboratories.)

"Effect of Inorganic Fillers in Greases on Wear of Anti-Friction Bearings"
MR. C. W. GEORGI,
Quaker State Oil Refining Corporation

Board of Directors Meeting and Luncheon
Lincoln Room
12:30 P. M.

Afternoon Session—2 p.m.—Ballroom

"Some Phases of Automotive Grease Lubrication"
MR. H. R. WOLF, General Motors Research

"Soap as a Lubricant"
MR. C. J. BONER,
Battenfeld Grease and Oil Corporation

"All Purpose Greases"
DR. E. M. KIPP,
Aluminum Company of America

Cocktails and Reception
West Lounge
6:00 P.M.

Banquet
Ballroom
7:00 P. M.

WEDNESDAY, OCT. 13, 1948

Meeting—Technical Committee
Ballroom
10:00 A.M.

SYNTHETIC LUBRICANTS

(Continued from page 7)

and oil temperatures have run as high as 160°F. At the high oil temperatures, it had not previously been possible to obtain pressures in excess of 1000 psi when using the SAE 20 oil.

At the last report, LB-140-X had outlasted the mineral oil by more than 2 to 1 and was still performing satisfactorily with no evidence of oil deterioration.

Hydraulic presses—A similar application is the use of LB-300-X in a 500-ton hydraulic press. This machine is equipped with a two-stage vane pump, delivering 25 gallons per minute at a pressure of 2000 psi and powered by a 60 hp motor. The synthetic lubricant has been in the equipment for the past year and the principal observation has been that there is much less difficulty in maintaining pressures at high oil temperatures than there was previously.

In general, favorable reports have been received relative to the adaptability of the synthetic lubricants for all types of hydraulic equipment which must operate over wide temperature ranges. Of particular interest are hydraulic hoists, lifts, riveters, and road building machinery.

Fire Resistant Hydraulic Oils

During the war, the demand for aircraft hydraulic fluids possessing low flammability characteristics resulted in the development of the so-called hydrolube fluids by the Naval Research Laboratory (6-9). These fluids are prepared by blending together, water, ethylene glycol, and a high viscosity soluble polymer and by adding to this mixture a combination of liquid and vapor phase inhibitors. Such a fluid is described in U. S. Navy Department, Bureau of Aeronautics, Specification 51F22 (Aer). One of the fluids conforming to the requirements of this specification is known as hydrolube "U" and contains 75-H-73,500, as the polymer thickening agent. Satisfactory performance of this fluid in aircraft hydraulic systems has been reported. Properties of hydrolube "U" are tabulated in Table VII.

Because of the interest which has been expressed in this type product by manufacturers and users of hy-

(Continued to page 19)

TABLE VII
Properties of Three Hydrolube-Type Hydraulic Fluids

	Hydrolube "U"	Hydrolube "300"	Hydrolube "550"
Viscosity			
Centistokes at 130°F.	10.0	34.5	70.9
Centistokes at 100°F.	16.5	59.5	119
Centistokes at 20°F.	116.5	485	990
Centistokes at 0°F.	247.4	1,213	2,378
Centistokes at —20°F.	614	2,968	......
Centistokes at —40°F.	1,797	9,753	......
Saybolt seconds at 100°F.	83.3	275	551
Density, g/cc			
At 130°F.	1.059	1.064	1.053
At 100°F.	1.070	1.076	1.066
At 60°F.	1.085	1.093	1.083
Freezing point, F	Below —76	Below —60	—15
Boiling point, F	211	209	209

SYNTHETIC LUBRICANTS

(Continued from page 18)

draulic equipment operating under conditions when the hydraulic oil constitutes a definite fire hazard, more viscous fluids of the same type as hydrolube "U" have been formulated by increasing the concentration of polymer. The water concentration has been maintained so that the flammability of the thicker fluids is not appreciably altered. Properties of two typical thickened hydrolube fluids having higher viscosities than hydrolube "U" are also included in Table VII.

The hydrolube-type fluids represent a relatively new development, but the interest which has been expressed in them during the few months since they have become commercialy available indicates that there are many instances where fire retardant hydraulic media are in urgent demand. Typical of the types of equipment in which these products have been tested are the following:

Die casting machinery—A prominent manufacturer of zinc and aluminum alloy die castings has been using one of these hydrolube-type fluids in hydraulically operated die casting machines for the past six months. These machines, having a capacity of 105 gallons of fluid, are equipped with vane pumps, and produce hydraulic pressures from 1000 to 1500 psi. Consumption of the fluid has been extremely low, since the hydrolube fluid does not appreciably attack the rubber hose lines in the system. Leakage in these lines had formerly contributed to the fire hazard. A report of this usage was recently presented before the American Society of Die Casters (10).

Manipulators—One of the applications which should be of particular interest to those in the iron and steel industry is the use of these low-flammability fluids in hydraulically operated manipulators and similar types of equipment. The rupturing of hydraulic lines on machines of this type when used in forging shops or similar locations could result in a serious fire hazard when accompanied by impingement of the petroleum hydraulic oil on a hot metal surface. A 6000-pound auto floor manipulator is shown in Figure

(Continued to page 20)

SYNTHETIC LUBRICANTS

(Continued from page 19)

3. One of the hydrolube hydraulic fluids has been in operation in two of these machines since March, 1947, and satisfactory performance has been reported. An inspection of the rotary piston-type pump, which activates the hydraulic system, after four months of operation showed the working parts of the pump to be in excellent condition. This pump operates at 850 rpm and 1200 psi, and the rated displacement is 25 gallons per minute.

Hydraulic presses — The same concern has also installed the hydrolube-type fluid in a 150-ton hydraulic press located in their blacksmith shop. The press is powered by a pump which operates at 1140 rpm and 2500 psi. Completely satisfactory performance has been reported during the six months that the hydrolube fluid has been in the press.

Other applications where the added safety of using a fire-resistant hydraulic fluid would be desirable include such equipment as furnace and combustion controls, mud guns, and various types of mining machinery. The synthetics are currently being evaluated for these uses.

High Temperature Lubricants

The superior burn-off properties and the non-sludging characteristics of these synthetic lubricants would indicate their suitability for certain high temperature applications. In this connection, the following uses are typical of those which have been developed.

Lubrication of glass manufacturing machinery—In view of the high operating temperatures encountered in the glass industry, it is not surprising that the synthetic lubricants should be particularly desirable for glass manufacturing machinery. Pictures of two bearings are shown in Figure 4. These bearings were removed from the rolls used to smooth and regulate the thickness of large glass sheets and operate at temperatures in the vicinty of 900°F. Although lubrication at these temperatures is not feasible, it is necessary to flush the bearings with oil periodically to maintain smooth operation of the rolls. The sludging encountered with mineral oil necessitates bearing replacement about every two months. The two bear-

(Continued to page 21)

SYNTHETIC LUBRICANTS

(Continued from page 20)

ings shown in the picture were installed at the same time in the same machine under as nearly identical conditions as possible. One of the bearings was flushed with mineral oil in the usual manner, and the other was flushed at the same time with equal quantities of LB-1145. Both bearings were removed when some of the mineral oil lubricated bearings in the machine failed because of excessive carbonization. Inspection showed the bearings lubricated by the synthetic to be relatively clean and in operating condition, while the others were frozen and clogged with hard deposits. Wear measurements indicated no appreciable differences in the diameters of the bearing rolls. The first machine in which these bearings have all been lubricated with the synthetic lubricant has been in operation for nearly a year without having to shut down for bearing replacement.

Another established application in the glass industry is the specification by a prominent manufacturer of LB-550-X as the lubricant for the revolving turrets of the hot cut flare machines used in the forming of light bulbs and related items. The minimization of sludge formation was the quality which again rendered the synthetic lubricants of value in this type of usage.

Graphited lubricant—The previously mentioned burn-off characteristics have been shown to be desirable in the development of graphited lubricants with one of the synthetics as carrier. Oven chain lubricants have been formulated which are characterized by the deposition of a soft, flaky, graphite coating after the carrier has burned off. This is in contrast to the "baked-in" graphite coating which is frequently encountered when mineral oils are used as carriers. These lubricants are currently being used in bakeries and in industrial baking and drying ovens.

Figure 2—Hydraulic machines, which must maintain constant pressure at various ambient temperatures such as this pressure welding machine, have had better service with the synthetic oils.

Packing impregnant—A packing manufacturer has reported that LB-1200-X is an excellent impregnant for asbestos steam packings. After these packings have been exposed to steam temperatures for prolonged periods of time, they remain pliable and can be relubricated. Mineral oil impregnants, which had previously been used, tended to carbonize and resinify with the resultant formation of hard, brittle packings which had to be replaced.

Heat transfer media — The improved heat stability of the synthetic lubricants has resulted in their

(Continued to page 22)

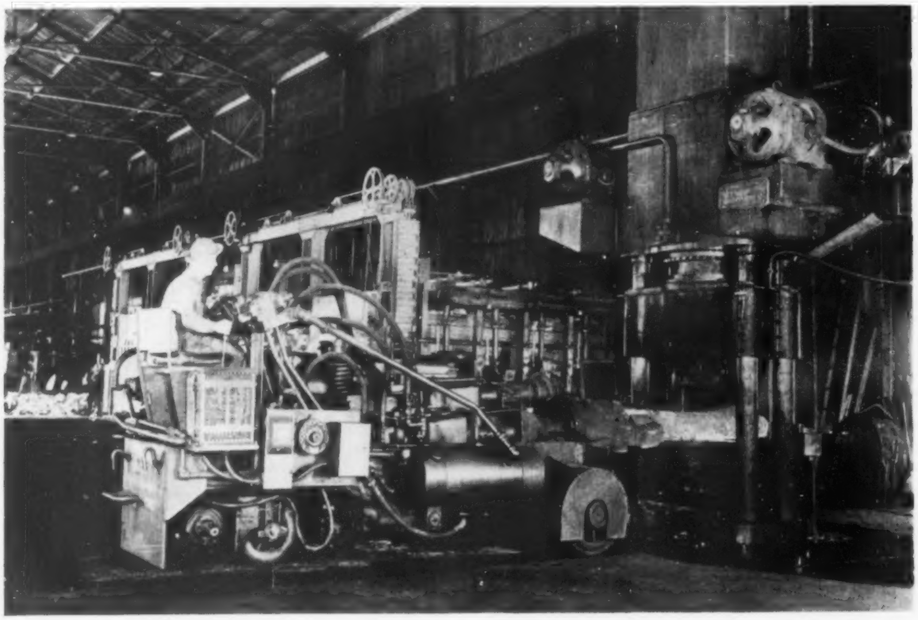

Figure 3—This 6000 lb. floor manipulator's hydraulic system, because of its use around flame and hot metal, can be more safely operated with a fire-resistant oil.

SYNTHETIC LUBRICANTS

(Continued from page 21)

frequent use as bath and heat transfer media in the 200-500°F. range. In one instance, a closed system, ing mixer, was filled with 50-HB-280-X and has been in intermittent equipped both for heating and cooling the liquid in a rubber compound-operation for a period of several months at temperatures ranging from 300 to 500°F. At the same plant this fluid is used in a vented laboratory bath which has been continuously maintained at 490°F. for a similar period with a negligible viscosity change. Another plant has been using the synthetic in all of their laboratory baths at temperatures ranging from 100° to 300°F. Metal heaters and parts immersed in the mineral oil bath had previously become coated with hard carbon deposits as much as ½ in. in thickness after two or three months of operation, and the bath oil had to be replaced frequently. After over a year of operation with the same fill of synthetic fluid, all metal parts are clean and the viscosity of the bath oil is essentially unchanged. In these and in other similar instances, the elimination of sludging difficulties has been particularly noteworthy. Volatilization of the fluid has not been excessive, although it increases appreciably at higher temperatures and the desirability of using closed, vented systems at temperatures in excess of 300°F. is indicated.

The examples cited above have been selected from various industries. Undoubtedly, steel mills and metal fabricating plants will offer many applications where the same unique properties of these synthetics can be utilized.

Metal Forming Lubricants

Several specialized metal drawing applications have been reported. Among them are the use of 50-HB-400 as the lubricant for drawing nickel silver and high phosphor bronze alloys and the use of 75-H-47,000 in the deep drawing of high nickel alloy transformer shields. It has also been found that 50-HB-400 is an excellent lubricant for drawing certain special high carbon steel wires. The synthetics seem to be readily adaptable to the drawing of tough, high tensile strength metals, for which aqueous solutions of soaps or soluble oils are frequently inadequate. They offer the definite advantage of ease of removal from the metal surface, either by completeness of burn-off in subsequent heat treating operations or, in the case of the water soluble lubricants, by water washing.

Another possibility which should not be overlooked is that of utilizing these synthetic lubricants as carriers for various types of additives used in conventional metal forming operations. One manufacturer has been studying the performance characteristics of different additives in 50-HB-400 as the lubricant for drawing

(Continued to page 23)

SYNTHETIC LUBRICANTS

(Continued from page 22)

stainless steel wire. Another concern is blending palm oil with LB-385 as a lubricant for drawing a tough, silver brazing alloy. Straight palm oil had been difficult to handle due to solidification and tended to become rancid with use. Although LB-385 performed satisfactorily, the die life was not as high as had been obtained with palm oil. The finished blend is said to incorporate the best features of both lubricants with none of the disadvantages of either. It is expected that the addition of certain colloidal graphite suspensions to various polyether lubricants or their aqueous solutions will offer many promising applications in the field of metal working.

Of interest to the steel industry is the possibility of utilizing the synthetic lubricants as roll oils for the cold reduction of steel strip. The superior burn-off characteristics should offer a definite improvement over palm oil and might make possible the elimination of a cleaning operation. Details of this application are currently being investigated in the laboratory.

Rubber Lubricants

The fact that both the "50-HB" and "LB" series lubricants show relatively little solvent or softening action on most types of natural and synthetic rubbers has resulted in their rapidly expanding use in applications involving rubber processing and lubrication. The success of the synthetics as hydraulic brake fluid constituents is to some extent dependent upon this property (3,5). Many tire manufacturers are using aqueous solutions of the 50-HB series as air bag lubricants in the molding and curing of tires. Other rubber fabricators have found that the water soluble fluids may be used as rubber mold lubricants. One manufacturer is using 50-HB-3520 as a mandrel lubricant in the fabrication of automobile radiator hoses. Another interesting use is that of 50-HB-3520 and LB-1145 as cutting oils for threading hard rubber storage battery caps. Several of these fluids, blended with suitable solvents, are being marketed as rubber shackle lubricants, and members of the "LB" series, in general, are serving as water insoluble lubricants for rubber bearings and joints. One concern has reported the adoption of LB-300-X for lubricating the rubber O-rings of pneumatic equipment

(Continued to page 25)

MEETINGS *of Your Industry*

SEPTEMBER

23 National Industrial Conference Board (general session of associates); Waldorf-Astoria, New York, N. Y.

27-28 Independent Petroleum Assn. of America (annual meeting); Plaza Hotel, San Antonio, Texas

27-28 Pennsylvania Petroleum Assn. (fall convention); Galen Hall, Wernerville, Pa.

OCTOBER

3-6 American Socy. of Mechanical Engineers, Petroleum Division; Herring Hotel, Amarillo, Texas

Week of OCT. 4 Manufacturers Standardization Socy. of the Valve and Fittings Industry (committee meeting week); Commodore Hotel, New York, N. Y.

4-6 American Institute of Mining and Metallurgical Engineers, Petroleum Division; Adolphus Hotel, Dallas, Texas

5-6 Oil Industry Information Committee; Waldorf-Astoria, New York, N. Y.

6-9 Society of Automotive Engineers (aeronautics and aircraft engineering display); Biltmore Hotel, Los Angeles, Calif.

7-9 Indiana Independent Petroleum Assn. (fall convention); Hotel Severin, Indianapolis, Ind.

8-13 American Trucking Associations (annual convention); Statler and Mayflower Hotels, Washington, D. C.

11-13 National Lubricating Grease Inst.; Edgewater Beach Hotel, Chicago, Ill.

11-13 American Society of Tool Engineers; Biltmore Hotel, Los Angeles, Calif.

12-16 National Chemical Exposition; Chicago Coliseum, Chicago, Ill.

13 American Socy. for Testing Materials (Philadelphia District); Franklin Institute, Philadelphia, Pa.

13-14 South Dakota Independent Oil Men's Assn.; Marvin Hughitt Hotel, Huron, S. Dak.

14 American Socy. for Testing Materials (Washington District); Wardman Park Hotel, Washington, D. C.

14-15 Petroleum Division, American Institute of Mining and Metallurgical Engineers; Elks Club, Los Angeles, Calif.

14-15 Texas Mid-Continent Oil and Gas Assn.; Fort Worth, Texas

15-17 American Oil Chemists Socy.; New York, N. Y.

20-22 American Standards Assn. (annual meeting); Waldorf-Astoria, New York, N. Y.

21-22 Socy. of Automotive Engineers (production meeting and clinic); Statler Hotel, Cleveland, Ohio

25-29 Thirtieth National Metal Exposition and Congress (A.G.A. will exhibit); Philadelphia, Pa.

28 Oil Trades Assn. of New York; Waldorf-Astoria, New York, N. Y.

28 Petroleum Motor Transport Assn. of Oklahoma; Mayo Hotel, Tulsa, Okla.

NOVEMBER

4-5 Socy. of Automotive Engineers, Fuels and Lubricants Division; Mayo Hotel, Tulsa, Okla.

7-10 American Inst. of Chemical Engineers; Hotel Pennsylvania, New York, N. Y.

8 Oil Industry Information Committee; Stevens Hotel, Chicago, Ill.

8-9 American Petroleum Institute (Lubrication Committee); Stevens Hotel, Chicago, Ill.

8-9 National Council of Independent Petroleum Associations (National Oil Jobbers Council); Sheraton Hotel, Chicago, Ill.

8-11 AMERICAN PETROLEUM INSTITUTE (28th annual meeting); Stevens Hotel, Chicago, Ill.

10 American Socy. for Testing Materials (Philadelphia District); Franklin Institute, Philadelphia, Pa.

15-17 American Petroleum Credit Assn. (annual conference); Hotel Roosevelt, New Orleans, La.

18 National Industrial Conference Board (general session of associates); Waldorf-Astoria, New York, N. Y.

28-Dec. 3 Exposition of Chemical Industries; Grand Central Palace, New York, N. Y.

28-Dec. 3 American Socy. of Mechanical Engineers (annual meeting); Hotels Pennsylvania and New Yorker, New York, N. Y.

29-Dec. 4 National Exposition of Power and Mechanical Engineering; Grand Central Palace, New York, N. Y.

DECEMBER

7-8 Nebraska Petroleum Marketers, Inc. (annual convention); Paxton Hotel, Omaha, Nebr.

16 National Industrial Conference Board (private session of board members); Waldorf-Astoria, New York, N. Y.

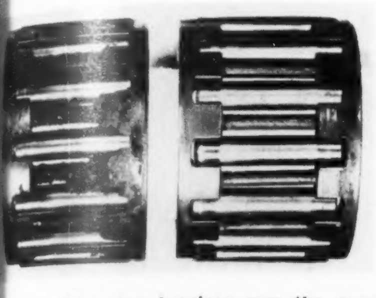

Figure 4—These two bearings saw the same amount of service on glass rolling machinery. The one on the left was lubricated with lubricant LB-1145; that on the right by a good grade mineral oil.

SYNTHETIC LUBRICANTS

(Continued from page 23)

throughout their plant. Ring replacement has dropped to about one-tenth the previous rate and a full time maintenance employee is no longer needed.

The above examples serve as an illustration of the adaptability of these synthetic lubricants in solving rubber lubrication problems. There are undoubtedly other instances where the same properties could be utilized.

Miscellaneous Applications

The uses which have been described are by no means all inclusive. Additional examples which are indicative of the wide range of utility of the synthetic lubricants are mentioned briefly below.

Electric motor lubricants — The lubrication of electric motors is an application in which sludging difficulties are frequently encountered. Reports have been received from a large plant which has used LB-300-X as the lubricant for 100 hp motors that maintenance shut-downs caused by the excessive sludging of mineral oil lubricants were practically eliminated during a period of the war when continuous operation was of vital importance. It is also of interest that a prominent manufacturer of fractional horsepower electric motors, after conducting exhaustive tests with various bearing materials, is adopting the low viscosity LB-X fluids as lubricants for certain wick-lubricated motors.

Low temperature lubricants—The low pour points and favorable viscosity-temperature relationships of these synthetics point toward their use in lubricant and hydraulic applications involving low temperatures. Of interest in this connection is the recommendation of LB-300-X by a manufacturer of industrial deep-freeze equipment. These motors operate at ambient temperatures ranging from —10° to 0°F. Another application is the use of an LB fluid as the lubricant for the push rods on liquefied hydrocarbon gas pumps. The synthetic prevents ice formation and has greatly increased the life of the packings.

Vacuum pump lubricants — The non-sludging characteristics of various members of the LB series point to their use as vacuum pump lubricants. Reports have been received from several sources that the use of these lubricants has resulted in much cleaner pump systems and that the solvent action of the synthetic fluid has effectively cleaned pumps which

(Continued to page 27)

TABLE VIII
Properties of Some Typical Synthetic Greases

Grease	Operating range degree F	Water solubility per cent	Dropping point degree F	Penetration
LT-64-F	—100 to 250	31	365	235
HT-1200	— 15 to 300	20	402	237
WS-400	— 15 to 220	Completely Soluble	333	250

SYNTHETIC LUBRICANTS

(Continued from page 25)

had heavy petroleum sludge deposits.

Greases — A series of specialty greases which are characterized by their applicability over wide temperature ranges, stability, high dropping points, and low rates of bleeding have been prepared in experimental quantities. Bearing life tests of these greases indicate their suitability for both low temperature and high temperature usage. While they are not, at present, commercially available, it is expected that they soon will be. Typical properties of three of these greases are presented in Table VIII.

This synthetic lubricant development is new and data from many of the uses are incomplete and of a fragmentary nature. Several of the specific applications which have been discussed appear to have little connection with the iron and steel industry, but the particular characteristics of these synthetic lubricants which have established them in these applications are characteristics which have a wide range of possible utilization. It is hoped that the information which has been presented will be of interest and value to lubrication and hydraulic engineers in the solution of some of their specific problems.

In many instances the cost of the lubricant or hydraulic fluid represents a very minor part of the cost of machines, servicing, repairs, and production loss due to shutdowns and inefficient operation. Therefore, superior performance of the lubri-

(Continued to page 28)

SYNTHETIC LUBRICANTS

(Continued from page 27)

cant or hydraulic fluid can easily justify the inherently higher costs of the synthetics. Without doubt there are many applications in the iron and steel industry in which these synthetic lubricants will fill a long awaited need and for which their use will be economically justified.

BIBLIOGRAPHY

1. *"New Synthetic Lubricants,"* by J. C. Kratzer, D. H. Green, and D. B. Williams, Petroleum Refiner, February, 1946.

2. *"Properties and Uses of Some New Synthetic Lubricants,"* by J. M. Russ, Jr., Lubrication Engineering, December, 1946.

3. *"Brake Fluids Face a Lively Future,"* by J. M. Fain, Chemical Industries, December, 1946.

4. *"Fleet Tests of Synthetic Lubricants,"* by D. K. Wilson, SAE National Transportation Meeting, Chicago, April, 1947.

5. *"Ucon, Synthetic Lubricants and Hydraulic Fluids,"* by J. M. Russ, Jr., Annual Meeting of American Society for Testing Materials, Atlantic City, June, 1947.

(Continued to page 29)

SYNTHETIC LUBRICANTS

(Continued from page 28)

6. "A Summary of Progress in Developing Non-Flammable Hydraulic Fluids for Use in Aircraft," by R. O. Militz, D. R. Spessard, and W. A. Zisman, Naval Research Laboratory Report, P-2944, August, 1946.

7. "The Development of the Hydrolube Non-Inflammable Hydraulic Fluids," by J. G. O'Rear, R. O. Militz, D. R. Spessard, and W. A. Zisman, Naval Research Laboratory Report P-3020, April, 1947.

8. "Determination of Ignition Characteristics of Hydraulic Fluids Under Simulated Flight and Crash Conditions," Technical Report No. 64, Civil Aeronautics Administration, April, 1947.

9. "The Flammability of the Higher Boiling Liquids and Their Mists," by M. V. Sullivan, J. K. Wolfe, and W. A. Zisman (to be published in Industrial and Engineering Chemistry).

10. "Research Report on the Use of Hydrolube Hydraulic Fluid," by B. E. Sandell, Meeting of American Die Casting Institute, Chicago, May, 1947.

Associate Members of the

ATIONAL LUBRICATING GREASE INSTITUTE

TED BELOW ARE THE SUPPLIERS OF YOUR INDUSTRY WHO ARE SUPPORTING YOUR ORGANIZATION THROUGH MEMBERSHIP IN THE N. L. G. I.

SUPPLIERS OF MATERIALS FOR MANUFACTURING LUBRICATING GREASES

our & Co., Chemical Division
55 West 31st St.
icago 9, Illinois
mber—Dale V. Stingley

rican Cyanamid Company
Rockefeller Plaza
w York, New York
mber—A. Scharwachter

y Industries, Inc.
rew Tower
ncinnati 2, Ohio
ember—R. F. Brown

o Chemical Corporation
orbes Road
edford, Ohio
ember—S. B. Elliott

le Mineral Company
Chelton Street
hiladelphia 44, Pennsylvania
ember—H. C. Meyer, Jr.

Gross & Company
5 Madison Avenue
ew York City 17, New York
ember—Eugene Adams

C. Hardesty Co., Inc.
East 42nd St
ew York City, New York
ember—W. G. McLeod

rshaw Chemical Company
45 East 97th Street
leveland 6, Ohio
ember—A. D. Perry

llinckrodt Chemical Works
econd and Mallinckrodt Streets
. Louis 7, Missouri
ember—C. E. Cosby

lasap Chemical Corporation
Harrison, New Jersey
ember—F. J. Licata

nsanto Chemical Company
700 Second Street
. Louis 4, Missouri
ember—J. W. Nemcombe

tional Lead Company
05 York Street
Brooklyn 1, New York
ember—Alexander Stewart

tional Rosin Oil & Size Co.
270 Avenue of the Americas
ew York City, New York
ember—Richard Bender

W. Parsons, Imports & Plymouth Organic Labs., Inc.
9 Beekman Street
ew York City 7, New York
ember—H. Bye

Warwick Chemical Company
Division of the Sun Chemical Corporation
10-10 44th Avenue
Long Island City 1, New York

The Werner G. Smith Co.
(Division of Archer-Daniels-Midland Co.)
2191 West 110th Street
Cleveland 2, Ohio
Member—F. C. Haas

Witco Chemical Co.
295 Madison Ave.
New York City, New York
Member—Allen B. Craig, Jr.

CONTAINER MANUFACTURERS

Central Can Company, Inc.
2415 West 19th St.
Chicago, Illinois
Member—Henry Frazin

Continental Can Co.
1103 Waldheim Building
Kansas City 6, Missouri
Member—N. M. Potts

Geuder, Paeschke & Frey Co.
324 North Fifteenth Street
Milwaukee 3, Wisconsin
Member—Willard J. Flint

Inland Steel Container Company
6532 South Menard Avenue
Chicago 38, Illinois
Member—J. T. Gossit

J & L Steel Barrel Company
70 East 45th Street
New York City, New York
Member—Jerry Lyons

United States Steel Products Co.
30 Rockefeller Plaza
New York City 20, New York
Member—Wm. I. Hanrahan

Vulcan Stamping & Manufacturing Co.
300 Madison Street
Bellwood, Illinois
Member—Dale M. Harpold

MANUFACTURERS OF EQUIPMENT FOR APPLICATION OF LUBRICATING GREASES

The Aro Equipment Corporation
Bryon, Ohio
Member—J. E. Allen

Balcrank, Inc.
Disney near Marburg
Cincinnati 9, Ohio
Member—R. P. Field

The Farval Corporation
3249 East 80th Street
Cleveland, Ohio
Member—A. S. Jennings

The Fil-Rite Company
342 Lumber Exchange Building
Minneapolis, Minnesota
Member—Howard G. Hornibrook

Gray Company, Inc.
600 N. E. Eleventh Avenue
Minneapolis 13, Minnesota
Member—L. L. Gray

Lincoln Engineering Company
5720 Natural Bridge Avenue
St. Louis, Missouri
Member—Foster Holmes

Stewart-Warner Corp.
1826-1852 Diversey Parkway
Chicago, Illinois
Member—Walter Duncan

U. S. Air Compressor Company
5300 Harvard
Cleveland, Ohio
Member—F. J. Coughlin

LABORATORY EQUIPMENT & SUPPLIES

Precision Scientific Company
3737 Cortland Street
Chicago 47, Illinois
Member—Alexander I. Newman

SUPPLIERS OF EQUIPMENT FOR MANUFACTURING LUBRICATING GREASES

Buflovak Equipment Division of Blaw-Knox Company
1543 Fillmore Avenue
Buffalo 15, New York
Member—A. W. Johnson

Cornell Machine Company
101 Park Avenue
New York City 17, New York
Member—Mead Cornell

The Girdler Corp.
Louisville 1, Kentucky
Member—John E. Slaughter, Jr.

Stratford Engineering Corporation
1414 Dierks Building
Kansas City, Missouri
Member—J. A. Altshuler

MARKETING ORGANIZATIONS

Refiners Marketing Co., Ltd.
555 South Flower Street
Los Angeles 13, California
Member—T. F. Harms

Southwestern Petroleum Co.
P. O. Box 789
Fort Worth, Texas
Member—J. W. Shugart, Jr.

REFINERS

Calumet Refining Company
4323 Southwestern Blvd.
Chicago, Illinois
Member— H. E. Semerau

TECHNICAL & RESEARCH ORGANIZATIONS

Armour Research Foundation
35 West 33rd Street
Chicago 16, Illinois
Member—L. O. Paul

Cargill, Incorporated
200 Grain Exchange
Minneapolis 15, Minnesota

Mellon Institute of Industrial Research
University of Pittsburgh
Pittsburgh 13, Pennsylvania
Member—Malcomb Findlayson

Midwest Research Institute
4049 Pennsylvania
Kansas City 2, Missouri
Member—Harold Vagtborg

or information concerning any products sold by our ASSOCIATE MEMBERS—Write the N.L.G.I. Office